ELEMENT STEWARDSHIP ABSTRACT
for

Xanthium spinosum

Spiny Cocklebur

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The Nature Conservancy
Element Stewardship Abstract
For *Xanthium spinosum*

I. IDENTIFIERS

Common Name: spiny clotbur, spanish-thistle, dagger cocklebur, daggerweed, spiny burweed, thorny burweed, bathurst burr

General Description:
The following description of Xanthium spinosum is adapted from Abrams (1940), Jepson (1951), Munz and Keck (1973), Robbins et al. (1970), and Holm et al. (1977).

Xanthium spinosum is an erect, rigid, much-branched annual herb, 3-10 dm tall and up to 15 dm or more wide. Stems are striate, yellowish or brownish gray, and finely pubescent. The cotyledons are linear-lanceolate in shape, differing in appearance from later developing leaves. True leaves are lanceolate, entire, toothed or lobed, 3-8 cm long, 6-26 mm wide, glabrous or strigose above, and silvery-tomentulose beneath. They are dull gray-green above with a conspicuous white midrib and short petioles (1 cm). Each leaf base is armed at the axil with yellow three-pronged spines 2-5 cm long, often opposite in pairs.

Flower heads are in axillary clusters or often solitary. Flowers are inconspicuous, greenish, and monoecious; male flowers in almost globular heads in axils of upper most leaves, and female flowers in axils of lower leaves, developing into a bur. The bur is two--celled, oblong, nearly egg-shaped, slightly flattened, 10-13 mm long, 4 mm wide, pale yellowish, more or less striate, glandular, covered with slender, hooked, glabrous spines from more or less thickened bases, with the two apical beaks short and straight. Each bur contains two flattened, thick-coated, dark brown or black seeds, the lower germinating first.

Xanthium is derived from the Greek, xanthos, meaning "yellow" and is thought to refer to a yellow dye obtainable from some species (Parsons 1973).

Unlike cocklebur (X. strumarium), spiny clotbur has conspicuous narrower leaves tapering at both ends, short petioles, conspicuous three-pronged spines at the leaf base, and egg-shaped burs covered with hooked, thorny prickles.

Diagnostic Characteristics:

II. STEWARDSHIP SUMMARY

III. NATURAL HISTORY

Range:

Habitat:
Xanthium spinosum, a native of South America, has now spread to at least 39 countries throughout the world, occurring between latitudes 43 egrees S and 50 degrees N. It is widely distributed in the mediterranean region and Europe, throughout most of Australia, in some coastal African countries, and in southern parts of South America and the United States. It is seldom found in the tropics (Holm et al. 1977). In California, spiny clotbur is common at low elevations throughout the state (Munz and Keck 1973). It was introduced to the state, probably by way of Europe, sometime before 1870 (Robbins 1940).

Xanthium spinosum does not exhibit the morphological diversity of X. strumarium and is considered the more genetically stable species (Love and Dansereau 1959). It is a weed of open areas and waste places. The plant grows along roads, in pastures, meadows, roadsides and disturbed areas. It is sometimes common around waterholes and along floodplains, canals, ditches, creek flats, river terraces, and other moist places.

Reproduction:
Xanthium spinosum has not been as extensively studied as X. strumarium, but the two species share many characteristics. In the Northern Hemisphere, spiny clotbur flowers between July and September, and fruits are produced from September to November. Most plants die in early winter (Parsons 1973). They produce an average of 150 seeds per plant.

The spiny bur has two elongated cavities, each containing one seed. The lower seed has a shorter dormancy period and germinates first. Dormancy of the upper seed has been found to be due to low permeability of the seed coat to oxygen (Crocker 1906, Davis 1930). Higher temperatures (32-38 C) or higher oxygen partial pressures can overcome dormancy. Both upper and lower seeds germinate readily if the seed coat is removed. The lower seed may germinate promptly or within a few months after maturity, but the upper seed may not germinate for several months or even years. This staggered germination means that the seedlings may emerge at any time over a period of several years during favorable growing conditions (Redosevich and Holt 1984).

Spiny clotbur has a high water requirement and does best on warm, moist soils. The seeds tend to germinate during the summer rains or whenever soil moisture is adequate. Sometimes seeds germinate out of season, and the resulting plants produce fruits out of season.

Xanthium spinosum was probably spread around the world by clinging to the hair or wool of animals, to clothing, or to feedsacks, muddy tools, etc. The seeds are sometimes dis¬persed in impure seedstocks and in weedy hay (Holm et al. 1977). The seeds float and can be spread by water. Parsons (1973) relates an unusual method of seed dispersal for spiny clotbur: "Some years ago an enterprising advertiser used the fruit of Bathurst burr as the bodies of imitation butterflies with paper wings bearing an advertisement, the

idea being that the butterfly would be thrown by passers-by to carry his message far and wide. This not only spread the message but effectively spread the weed." In Argentina, Xanthium spinosum has reportedly been used as a medicinal plant (Holm et al. 1977)

Spiny clotbur is one of the world's worst weeds (Holm et al. 1977). It is a serious weed in many agricultural crops and in animal production. Spiny clotbur seeds are easily spread, due to their ability to float and to "hitchhike" on humans and animals. The plants can quickly become dominant in an area due to prolific seed production and high germination and survival rates. The presence of two seed types in each bur also in-creases its survival chances.

The plant invades pastures and grazing lands, causing reduced forage production. It is not palatable to stock and becomes entangled in the wool of sheep and pets. Xanthium species are toxic to most domestic animals, particularly swine and horses. The poisonous compound in X. strumarium (and presumably in X. spinosum), carboxyatractyloside, is present in seeds (Cole et al. 1980). When ingested at 0.3 percent of an animal's body weight, the seed will cause toxicity; but this situation rarely occurs because the spiny burs are not palatable to animals.

When seedlings are in the cotyledonary stage, they are palatable but also have the highest toxicity. Poisoning generally results when these leaves are eaten. This situation occurs most often at the edges of ponds, lakes, floodplains, or other bodies of water where shallow flooding followed by recession of the waterline occurs. Under such conditions seeds germinate readily, constantly supplying new generations of potentially poisonous seedlings as the water source dries out. Animals are attracted to such areas because of their need for drinking water. The problem is accentuated because Xanthium seeds have a natural dormancy and can germinate over long periods of time. Ingestion of cotyledons to 0.75 to 1.5 percent of the animal's body weight will cause toxicity.

Toxicity decreases rapidly as true leaves are formed. Evidence of poisoning appears in about 12 to 48 hours, the symptoms being nausea, vomiting, lassitude, depression, weakened muscles, and prostration. Sever poisoning may result in convulsions and spasmodic running movements. Ruminants may not vomit, but death may occur within a few hours or days. Fatty substances such as milk, lard, or linseed oil have been recommended as antidotes (Kingsbury 1964). The toxic agent in Xanthium may also be responsible for allelopathic effects (Cutler 1983).

IV. CONDITION

V. MANAGEMENT/MONITORING

Management Requirements:
Xanthium spinosum is a common annual weed spread by water and by contact with humans or animals. It is native to South America, but has spread throughout the world. Spiny clotbur is a weed of open places, particularly sites with warm, moist soils. It

reproduces from seeds that are viable for up to several years. Biological control measures are currently being investigated and may prove effective in the future. simple mechanical removal prior to flowering is recommended for control. If pulled following flowering, the plants should be burned. Monitoring should be continued on the sites for several years.

Control of Xanthium spinosum requires active management once it becomes established in an area. Control measures should aim at preventing seeding for at least three years (Parsons 1973).

With the right combination of control measures, it should be possible to eliminate spiny clotbur from selected areas. Constant monitoring will be necessary since it can quickly re-establish from seeds. In shaded areas, drier sites, and where competition from other plants is strong, cocklebur control will be easier. Conversely, where light, soils, and water levels are appropriate, the weed will be much more difficult to eliminate.

Monitoring is needed to determine the effectiveness of cocklebur control measures. These will vary depending upon the degree of the problem on a given preserve.

MECHANICAL CONTROL

Frequent cultivation of fields can control Xanthium spinosum (Holm et al. 1977). Physical removal of the plants by hand pulling or hoeing is effective if done prior to flowering. Since the dormant seed can remain viable for several years, periodic inspection of the area will be necessary, and grubbing may have to be carried out to deal with subsequent germination. Hoed or pulled plants on which the burs are already formed should be removed and burned as the seed can mature even on cut stalks (Australia Dept. of Agriculture 1974). Mowing or rotary slashing will give effective control, but here again it should be carried out before burs are formed. There is a danger also that after cutting some burs will be formed on the cut stems close to the ground (Parsons 1973).

PRESCRIBED BURNING

Prescribed burning is an effective means to destroy Xanthium spinosum seeds, but prescribed fire has not often been used for this purpose.

BIOLOGICAL CONTROL

A fair amount of research has been conducted on insects associated with spiny clotbur. Most of the insect associates of Xanthium in California are polyphagous species. Twenty-one species have been found associated with spiny clotbur in southern California (Hilgendorf and Goeden 1983). Eleven of these species are also major or minor pests of cultivated plants. Seven species associated with spiny clotbur are endophagous (Diptera) and apparently are host specific to Xanthium š(Hilgendorf and Goeden 1983). The fruit fly, E. BULLANS, like its only known host plants (Robbins 1940), is apparently an accidental introduction from South America.

Little is known about Oedopa capito, which is widely distributed in North America (Cole 1969). O. capito may have followed Xanthium into California or it may be an undescribed native species that transferred from unknown composites other than ragweeds and Helianthus species. Hilgendorf and Goeden (1983) suggest that Oedopa sp. is probably the only insect species worthy of study as a potential biocontrol agent for Xanthium.

Studies of insects associated with spiny clotbur have also been conducted in Kansas (Kelly 1931) and Texas (Wilson 1960). Six species were introduced to Australia in an unsuccessful attempt to control Xanthium (Wapshere 1974). Insect associates of Xanthium have also been studied in India (Wilson 1960) and Pakistan (Baloch et al. 1968). Neither area provided useful biocontrol agents. Baloch and Ghani (1969) suggest that using a combination of several insects species with different feeding habits would improve the chance of suppressing Xanthium špopulations.

The rust Puccinia xanthii Schw. is an obligate parasite of species of Xanthium and Ambrosia and occurs throughout the United States, southern Canada, parts of Europe, and India (Conners 1967, Hasan 1974, Alcorn 1975, Jaghav and Somani 1978). It attacks all aerial parts of the plant except the flowers. Infected plants mature more rapidly than healthy plants and show decreased transpiration, dry weight, bur production, and percent germination (Hasan 1974, Julien et al. 1979). The spores overwinter on dead plant parts.

Fungal and bacterial pathogens have had some success in controlling Xanthium strumarium in India (Deshpande 1982). Orobanche ramosa L. (broom rape) is a parasitic plant found on a variety of cultivated and weedy plants, including Xanthium (King 1966, Polunin 1966, Munz and Keck 1973).

Weaver and Lechowicz (1983) list 14 species of fungi that infect Xanthium in the U.S. and Canada. Colletotrichum xanthii has caused death of X. spinosum in areas of summer rainfall in New South Wales, Australia (Wilson 1960, Nikandrow et al. 1984). The disease is favored by wet weather during summer and autumn. Seedling plants may be killed before the four-leaf stage, and in older plants, lesions are formed on stems which may be šgirdled. Seed production may be only 10 to 20 percent of normal, and viability may be reduced. The disease can be established artificially in the field and will then persist naturally. The fungi zinnia mildew (Erysiphe cichoracearum) and Verticillium dahliae are also reported to infest Xanthium spinosum (Holm et al. 1977).

CONTROL BY GRAZING

Because of its toxicity and unpalatability, grazing is not a useful control method for Xanthium spinosum.

CHEMICAL CONTROL

Spiny clotbur is susceptible to a wide variety of soil- and foliar-applied herbicides commonly used for the control of broad-leaved weeds (Weaver and Lechowicz 1983). Near streams or lakes, particular caution should be taken when using herbicides. Dr. Jim

McHenry (1985), of the University of California, Davis, recommends the following herbicides for cocklebur control on California's preserves:

2,4-D is a phenoxy-type herbicide used for broadleaf weed control (it does not affect grasses) that acts as a selective hormone or growth regulating type. The chemical is non-corrosive and is generally considered non-harmful to wildlife. It persists in the soil for 1-4 weeks. For spiny clotbur control 2,4-D ester should be applied to the plants at the 3-5 leaf stage of growth. It is more effective than the amine form in penetrating the cuticular wax on the leaves. Application should be at the rate of 1-1.5 lbs/100 gallons of water with 1 quart of surfactant/100 gallons.

Banvel (dicamba) is a broad-spectrum herbicide used against perennial broadleaf weeds. It is non-flammable and non-corrosive and has a low order of toxicity to fish and wildlife. It persists in the soil for 8 weeks. It is usually mixed at 4 lb/gal. Dicamba is more selective than 2,4-D.

APPLYING HERBICIDES

Herbicides can be applied uniformly over an area (for large infestations) or by spot spraying only the individual plants. Dr. McHenry recommends using a flat-fan nozzle (Spraying Systems Co. #8003 or 8004 nozzle tip) rather than the cone nozzles available on most garden sprayers. Cone sprayers produce greater atomization of the chemicals and increase the chance of drift into unwanted areas. Spraying should be done on calm days with dry plants (dew or rain will dilute the herbicide, reducing its effectiveness). When spraying large areas, a horizontal boom (6-8 feet long) made from aluminum tubing will improve herbicide coverage.

VI. RESEARCH

Management Research Needs:

Xanthium spinosum has not been studied as thoroughly as X. strumarium. Research is needed pertaining to control measures, e.g., effects of prescribed burning on the plants and seed germination, and on biological control.

VII. ADDITIONAL TOPICS

VIII. INFORMATION SOURCES

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IX. DOCUMENT PREPARATION & MAINTENANCE

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